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R. M. DeNio, Director, Division of Range Management

May 1, 1962

F. J. Smith, Chairman, Range Seeding Equipment Committee

Range Improvements

There follows a report of the sixteenth annual meeting of the Range Seeding Equipment Committee, held at Robert Driscoll Hotel, Corpus Christi, Texas, on January 21 and 22, 1962. A copy of each written report submitted is attached to the original of this report.

The report of the proceedings of the meeting are arranged in the following order:

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Frank J. Smith

REPORT OF THE SIXTEENTH ANNUAL MEETING OF THE RANGE SEEDING EQUIPMENT COMMITTEE

Corpus Christi, Texas
January 21-23, 1962

The sixteenth annual meeting of the Range Seeding Equipment Committee was called to order by General Chairman Frank J. Smith, 10:45 A.M., January 21, at Robert Driscoll Hotel, Corpus Christi, Texas. The registered attendance totalled 72 persons representing Federal and State agencies, colleges and others interested in equipment development from all parts of the United States.

Because of transportation difficulties of attending individuals, it was not possible to follow the prepared program; however, the report will follow the outline of the meeting as scheduled, without regard to order of presentation.

The following are summary reports of papers presented at the meeting. A complete copy of the full report submitted is attached to the original of this report.

Operating Hints and Handbook

Subcommittee Chairman - A. C. Hull, Jr., ARS

Three committee assignments with action taken:

1. Range Seeding Handbook - Types of equipment with recommendations as to where useful. Mainly for program planning. Revised and issued by Superintendent of Documents as a loose leaf in January 1957. Cost about 80 cents; selling price, $1.25.

2. Operating Hints - Proper use, servicing, and storage of machinery. Mainly for field operations. Four thousand copies printed and distributed March 1961. Cost 5.6 cents per copy.

3. Service Manuals with parts list - Maintenance and servicing, mainly in shops. Commercial manuals will be used where available. Manuals will be prepared only for newly developed equipment such as the Brushland plow. Two hundred copies of the Brushland plow manual issued during 1961. These copies are gone and the manual should be reprinted.

Recommendations

FY 1962

1. Complete Rangeland drill manual and print approximately 500 copies. Assigned to Silva.

2. Reprint approximately 300 copies of the Brushland plow service manual. Assigned to Silva, Wagner, and Bradley.

3. Revise Rangeland drill portion of Range Seeding Handbook. Cooperative between the Rangeland drill and Handbook subcommittees.

FY 1963

1. Revise or add sections of the Range Seeding Handbook as needed. Some considerations are: Transportation equipment, Oregon press seeder, Browse seeder, and Holt trencher. Cooperative between these subject matter subcommittees and the Handbook subcommittees.

2. Prepare Brush cutter and Oregon press seeder manuals. This may be delayed until FY 1964.

Procedures - Subcommittees working with specific equipment to prepare manuals and make revisions for the Handbook. When in final shape, material should come to A. C. Hull who will arrange for review by the Handbook subcommittee. After review Joe Wagner and George Bradley will arrange for financing, printing, and distribution.

Finances - Subcommittees submitting manuals, write-ups, and revisions will include printing costs as part of their budget.

Rangeland Drill Improvement

Subcommittee Chairman - A. B. Evanko, FS

A. B. Evanko reported on design and fabrication of an accessory bar, to act as a brush compressing device for compacting and passing loose brush between the two center disc openers. The unit is complete; plans call for testing in Northern California. The Rangeland Drill Handbook write-up is prepared, and will now be edited and submitted for publication. This includes use, repair, and procurement of parts. Arcadia is working on the Service Manual and Parts List.

Recommended that Rangeland Drill Improvement Subcommittee be continued, but no activity for next two to three years.

Improvement of Brushland Plow

Acting Subcommittee Chairman - Leroy C. Sweet, BLM

At last year's meeting it was found desirable to retain the brushland plow subcommittee - for continuing an appraisal on the need for additional improvements on the plow. Mr. Andrews, BLM, and Mr. Mullin, FS, were appointed to the committee.

From the request for suggested improvements by the chairman, some fifteen replies were received from Forest Service and BLM offices. As some of these consolidated Regional or State reports, well over twenty offices were heard from, which appears quite representative. It is noteworthy that the majority of the replies were of the O.K. or no comment variety, indicating generally that the brushland plow units now in operation are performing the job for which they were designed.

Some writers apparently had not learned of the improved disc axle bearings on the current model or suggested modifications on older units; or had not heard of the parts stockpile maintained at Stockton, California. Agency representatives, particularly BLM, need to make certain all their field offices and shops where these plows are used have copies of the "Equipment Service Manual and Parts List for the Brushland Plow."

Several comments were received regarding the weight of the equipment and that the difficulty of transporting, loading and unloading, as well as the drawbar power requirements, make the units unattractive to contractors. Some noted they are not too interested in the brushland plow as commercial plows of the wheatland type are doing as good or better job at less cost per acre. It must be remembered - the brushland plow was developed to fill a specific need - to plow rough sagebrush areas where rocks, heavy roots, or other solid objects may be encountered. The plow is heavy--it was designed that way, to withstand the rough treatment it gets.

There is no question but that lighter weight, less cumbersome equipment can be operated at lower cost. Where it will obtain satisfactory results, it should be used. However, the brushland plow still has its place and is being used with excellent results for its designed purpose.

As most of the recommendations for changes deal with items or parts that have been corrected on current models, it is questionable if a subcommittee for the improvement of the brushland plow need function during the coming year.

Gene Silva, Arcadia, reported on work done on mechanism for a lifting and steering plow. In essence these features could be added, but are not economically feasible, nor is there a demand for them.

Parts Stocking for Rangeland Drill and Brushland Plow

Subcommittee Chairman - Everett Doman, FS

A central parts stock facility for hard-to-get parts for the rangeland drill and brushland plow was established in 1960 at the U. S. Forest Service Equipment Depot at Stockton, California, through the efforts of the Range Reseeding Equipment Committee. Forest Service funds to the extent of $10,000.00 were made available in Fiscal Years 1960 and 1961, to provide initial stocks of parts, and facilities for stocking. Parts for the rangeland drill were stocked in 1960 and parts for the brushland plow in 1961. Both stocks have been drawn on regularly since by member agencies of the committee. No parts stocks were set up for the contour furrower because of the few parts required and the interchangeability of many parts (¼" by 24" discs for example) with the brushland plow. The report that follows is a summary of operations at Stockton to date.

Parts and Price Lists

1. Brushland Plow - The parts and price list that is part of the new Equipment Service Manual and Parts List for the Brushland Plow (1961) is still the effective list that should be used for ordering. There

has, however, been no call for unmachined castings and those in stock are in the process of being machined and reworked into finished items. Any request for unmachined parts in the future, should any occur, will be back ordered from a manufacturer.

2. Rangeland Drill - Attached is an up-to-date parts list for the rangeland drill. This is the same parts list that was circulated with a letter of January 13, 1961, from the Subcommittee on Parts Acquisition to all Range Reseeding Equipment Committee members. As indicated in last year's report to the Committee, this is not a desirable way to circulate a parts list. The most desirable way is to make it part of a manual similar to the new Equipment Service Manual and Parts List for the Brushland Plow. Such a recommendation was made at last year's Committee meeting. If such a manual is not going to be prepared, the parts list should become part of the rangeland drill section of the Range Reseeding Equipment Handbook.

Missing Information

Information is still lacking from the Bureau of Indian Affairs and the Forest Service, Regions 1, 2 and 4, on the amount of and location of drills and plows. Such information is needed to provide a basis for maintaining stock levels. The data to be effective should include the following:

1. Location of machines (should include unit as well as Region where machines are located).

2. Condition.

3. Year manufactured.

4. Attachments.

5. Some indications of the future planned use for a machine--for example, plans for the next five-year period.

6. Plans for additional machines.

The following is recommended for FY 1963:

1. Greater use be made of the Stockton parts facility.

2. A project either be initiated to prepare a Service Manual and Parts List for the Rangeland Drill similar to that for the Brushland Plow or the parts list for the drill be included in the appropriate section of the Range Reseeding Equipment Handbook.

3. Number and distribution of the Service Manual and Parts List for the Brushland Plow be reviewed for adequacy and completeness.

4. Units not having already done so furnish Forest Service, Region 5, San Francisco information on machines on hand, etc., as indicated in B6. (Copy of Rangeland Drill Parts Stocked at U. S. Forest Service Equipment Depot, 1611 South Airport Way, Stockton, California, should be inserted here.) (This is at end of Exhibit #4.)

Browse Seeding Equipment

Subcommittee Chairman - A. Perry Plummer, FS

The major objective, to develop a deep furrow-scalping machine that will satisfactorily plant browse seed under a variety of wildland conditions, has to a degree been attained. This implement with one or two planting units can be readily pulled with most any tractor or a jeep equipped with a 3-point hitch. Perhaps it does not do the whole job perfectly, but anyway we have a machine that does the job on a practical basis. Preliminary trials indicate this browse planter is rugged enough to withstand severe use on rocky sites, and it also performs well on sites without rocks.

Equipped with appropriate scalpers it appears to have the capability of eliminating competition of cheatgrass brome as well as other annual weeds. This was one of the important objectives to be achieved. Incorporated in this planter are most of the better features of the Hansen furrower and the Idaho double-wing scalper. Other desirable features are also included. While there is perhaps considerable yet to be done to perfect and make the instrument better, three pilot models have been completed. The first one was purchased by the Idaho Fish and Game Department. They wanted to retain the machine to continue a sizeable restoration program. Actually it was taken in lieu of a Hansen furrower-seeder that they had earlier ordered. They preferred this type machine. Two other somewhat smaller models have been completed, one being purchased by the Manti-LaSal Forest and the other by the Dixie Forest. These were also taken in lieu of the original Hansen furrowers that had been ordered. So, actually, the manufacture of these machines has been of slight expense to the money set up for expenditure by this committee. A machine has been ordered by the committee but has not been completed. The Walter Hansen Machine Company has been waiting to get further reaction from the machines now in the field before final completion.

Background

By way of background this present machine results from comparative tests of the Hansen furrower-seeder and the Idaho double-wing seeder at the Great Basin Research Center at Ephraim, Utah, in September 1960 by the subcommittee. A major new innovation prescribed for the machine was that seeding units along the tool bar have some adjustability for row spacing.

In summation, we think a prototype has been developed which can be modified to accomplish a variety of planting jobs on wildlands. The possible modifications bear a lot of careful study. The machine appears to have real usefulness for planting on agricultural lands as well as wildlands, and especially for seeding legumes or other desirable species into soddy grass pastures. Certainly it can be a useful implement for curtailing erosion on sloping land. Other modifications may make it more useful for this purpose.

Mr. Hansen believes that he can manufacture this machine with two moldboard or scalper furrowers and two seeding units for $500 each. If demand were such that assembly line production were possible, prices could probably be cut considerably under his $500 estimate.

Browse Seed Collector

Subcommittee Chairman - Max Bridges, BLM

Early in the spring of 1961 a preliminary investigation was carried out to gather as much information as possible on browse-bitterbrush, its size, seeding habits, and the conditions under which it grows. Further investigation was made into methods that have been tried in harvesting the seed, and possibly types of equipment that might be suitable.

After this information was obtained and evaluated, equipment was assembled to determine optimum methods. An engine, blower and seed separator provided the vacuum supply. Several seed collecting devices were fabricated including a flail and apron. Seed was carried from the collector through a hose to the separator. A six- and a ten-inch diameter hose was tested and with the various collecting devices provided twelve combinations.

The six-inch hose with a simple collar proved the most successful. There was less fatigue with equal or more production than any other device tested. Results indicate machine harvesting is about 2½ times faster than hand collecting. Information gained from this study will permit the design of a compact unit suitable for mounting in a Willys jeep.

This investigation was carried out by visiting stands of the most desirable species of browse-bitterbrush and talking with rangers, ecologists and manufacturers of seed harvesting equipment.

Conclusions from the Preliminary Investigations

1. A modification of the guayule seed harvester holds great promise as a method to harvest bitterbrush seed from plants grown in a nursery.

2. The guayule seed harvester will not work in natural stands of bitterbrush.

3. For field harvesting a vacuum type machine seems to hold the greatest possibility of being economical and practical.

Description of Equipment

The prototype bitterbrush seed collector consists of a flexible hose, a separator, a blower and an engine (in reality a large vacuum cleaner). Both 10" and 6" Flexaust hose were tested.

Requirements for a Production Model

If a production model were to be built now the following is a list of requirements, indicated by our field testing the present prototype model.

1. A production model should be small enough to be carried by a jeep.

2. The model should have two 5- or 6-inch hose which are supported by a boom and long enough so a man could work on both sides of the jeep in full view of the driver.

3. The blower should be capable of pulling 15 inches of water at 1,800 cfm.

4. The engine and blower exhausts should exit to the rear of the unit. This would reduce the noise in the area of the operator, for by listening to the noise in the hose he can tell if he is collecting any seed.

Recommendation

It is recommended that a compact browse-seed harvester be built suitable for mounting in a Willys jeep.

Catchment Basin

Subcommittee Chairman - C. E. McDuff, FS

The committee assignment was to determine what is known about providing ample water for foraging animals through use of catchment basins. The known attempts to solve this problem have necessarily been quite similar in approach. The use of materials has been quite varied.

Natural catchment areas and storage tanks have been successfully produced by compacting the soil with a sheeps' foot roller, by driving bands of sheep over the area to be compacted, or by other methods that achieve the desired compaction. The use of rock salt and other chemicals has been successful in some applications. All of these methods of treatment require maintenance.

Artificial catchments with closed or open storage have been used by a great many individuals and organizations and a very wide variety of water developments has resulted. Some developments have been disappointing chiefly because of the short life of materials used. Others appear to deserve much wider tests and application.

It is very evident to all of us who have worked with this problem that a major part of the problem is the loss of water to evaporation. Many of these tanks no deeper than 5' or 6' at the deepest part, constructed in an area that can expect 7' of evaporation, need little study to determine why they fail.

The report was supplemented with a film by BIA showing catchment basin construction. For further information also refer to paper delivered by Joseph B. Chiarella at the Range Society meeting, "Progress and Development of Catchment Basins."

Brush Cutting and Brush Beating Equipment

Subcommittee Chairman - Grant P. Rogers, BLM

Plans for Fiscal Year 1962 on this project called for minor structural modifications by the Arcadia Equipment Development Center and further field testing of both the front mounted and trailer units.

This report will include portions of the report on the heavy duty trailing brush cutter as conducted at Ely, Nevada, by the Bureau of Land Management, also portions of the report of the studies and field tests conducted in California on the San Bernardino Forest.

In Nevada the average sagebrush stubble height after treatment was six inches. The brush cutter had no trouble in cutting the sagebrush which varied in diameter up to three inches. All brush was chopped to small pieces ranging from six to twelve inches long.

Considerable difficulty was experienced in trying to get the brush cutter to cut the stubble closer to the ground. Cause of this problem was the cutter's apron.

The California tests on the San Bernardino Forest showed:

Performance of both the front-mounted and towed units was quite satisfactory. The quality of cutting was considered comparable for the two units. A tendency toward "bunching" was noted with the towed unit when an exceptionally dense brush clump was encountered. However, this was attributed to a lack of experience by the operator. Operators had received but about one day of training in operation of the cutters.

Height of cutting was controlled to provide a 2"-3" stubble. Brush stems were cut into pieces of variable length. Larger stems (2" and up) averaged about 2½ feet long.

No particular difficulty was experienced with chamise, white thorn and manzanita. Forward progress could be maintained at a steady rate with a minimum of cutting height adjustment. These species tend to be brittle and cut or break readily. Most stems of these species were in the 1"-3" diameter class.

Scrub oak, on the other hand, was considerably more difficult, depending upon its size and density. Accomplishment was materially reduced where stem diameters of about 4" and up prevailed. Under these conditions, it was necessary to adjust cutting height and to make a double pass to do an adequate job. Equipment breakdown in this type was common. Resistance to cutting is primarily due to the fibrous characteristic of oak stems. It is doubtful that any other woody plant of comparable size would present a more difficult cutting problem with such equipment.

The committee is quite enthusiastic about the cutter's performance. It may be desirable to determine cutter capacity in 6" diameter material. The committee is of the opinion that the equipment will adequately treat most California brush stands in which the maximum stem diameter will be about 4 inches.

Conclusions from Arcadia Tests

1. The production rates of the two machines are essentially equal at approximately one acre per hour in light and medium brush, but the production of the trail type slowed to slightly less than half an acre per hour in heavy dense brush, while that of the front-mounted unit remained close to an acre per hour.

2. The large proportion of mechanical problems encountered on plot #1 indicates that the cutting of the large, hard oak brush stressed the machines over the average for which they were designed. This is supported by the comments of observers who noted the extreme difficulty with which the units progressed. Any large operation in this type of brush would entail considerable down time and maintenance costs.

3. The rubber tires give satisfactory service in most situations with the exception of areas which have short, hard stems protruding from the ground such as are found in burned-over areas.

Recommendations

1. Further study of the trail type brushcutter on operations in brush of the type and density of that found in plot #2 should be undertaken to determine the reason for the large difference in production rates between the two units.

2. The Caterpillar D-7 tractor which carries the front-mounted brushcutter should be repaired or replaced.

3. A more sensitive method of raising and lowering the front-mounted unit should be designed. A hydraulic system would probably provide the control which the cable system does not.

4. An indicator should be provided to tell the operator of the front-mounted machine if the engine has stopped.

5. A better method of securing the blade bolts on both units is needed. (Double nuts in place of single locking nuts are being tried at present.)

6. Different supports should be designed for the exhaust and intake systems of the front-mounted cutter engine.

7. An adjustable clevis type hitch should be provided on the trail type unit to cope with the problem of different drawbar heights of tractors. (This has been done.)

8. The hydraulic hose of the trail type cutter should be fastened together and more closely confined. (This has been done.)

Evaluation of Root Plows

Subcommittee Chairman - Carl S. Fonte, SCS

In reviewing the report of 1960 and work accomplished prior to 1961, we find:

The results of this work accomplished prior to 1961 was highly variable with the kill of brush varying from 20-90% and the cost from $5.00 per acre on sageland to $25.00 on oakbrush.

1. The Southwest Region of the U. S. Forest Service reports: The root plows and exhaust seeders performed satisfactorily.

2. The Rocky Mountain Region of the U. S. Forest Service reports:

   The only difficulty encountered, other than mashing down heavy brush ahead of plowing, was excessive ground moisture. This was due to heavy rainfall which made the tractor and plow operation practically impossible on the heavy clay soils.

   Results of plowing that was done a year ago in June show less than 5% sprouting of the oak. It appears that this sprouting is occurring where the depth of plowing was not consistent, such as where the plow pulled out on account of rock.

3. The SCS reporting on private lands in the White River Area near Meeker, Colorado, states that:

   The root plow seems to have only a limited use in this area, and that is where the landowner is clearing the oak and serviceberry for reseeding to pasture with introduced species.

   The results on native range seem to be good as far as control of the brush, but the cost of $16.00 per acre for plowing only is still too high for most ranchers. Also, there is a dislike for the amount of native forage plants killed. The cost of around $12.00 for plowing on sagebrush is still fairly high. Therefore, ranchers prefer sagebrush spraying over root plowing.

   On plots established in 1958, in the Gunnison River Area near Crawford, Colorado, the following conditions were reported:

   a. About 75% or more of the oak, serviceberry and snowberry were killed.

   b. A small percentage of seeded grasses survived. Intermediate wheatgrass shows up the best.

   c. The rancher has stated he does not like the root plowing. He prefers the method of cutting the brush with a rotary cutter and re-do it every two years.

It is the opinion of SCS technicians that the results of the root plowing on this plot may have showed up more favorably if:

a. Root plow would have had a shaker attachment to remove soil from the roots, thus the sprouting of oak would have been reduced.

b. Grazing management had been more consistent with good land use, such as deferred grazing for two years following the plowing.

The ARS did not evaluate the root plow plots in Western Colorado this year, but expect to resume their evaluation in 1962.

The Fleco Corporation reports successful operation of the root plow on many acres in the South and Southwest areas infested with mesquite brush.

The Committee feels that the root plow has a very definite place in the land treatment program and should be encouraged in clearing land for pasture or cultivation and elimination of willows on certain areas of hayland and cropland. Definitely, more work should be done on the oakbrush type. Also, that work should be continued in trying to reduce the cost of operation of the machine, thus making root plowing more applicable to rangeland areas.

In addition, Joe Chiarella reported on root plowing results in Arizona and illustrated his report with movies of the job.

Develop Broadcast Seeder

Subcommittee Chairman - E. E. Silva, FS

Chairman asked for reconfirmation of specifications. No commercial models were found qualified to specifications set up, though most commercial seeders available were adequate. Arcadia will prepare report for next year.

Evaluate Oregon Press Seeder

This is the second year for the Oregon Press Seeder as a project of the Range Seeding Equipment Committee. In addition to the original pilot models there are now 12 seeders in use. The Bureau of Land Management has ten, the Forest Service and Bureau of Indian Affairs each have one. The seeder was originated by Squaw Butte Experiment Station and the pilot models engineered by Oregon Agricultural Experiment Station. It was developed for use on dry, loose seedbeds that are often found in the sagebrush-bunchgrass areas.

Several questions developed as a result of the experience in fabrication by the Holt Machinery Company. They dealt with simplified construction changes, lack of availability of some items, and improvements to lessen operational breakdowns. Mr. Holt, Mr. Booster of Oregon State University, Mr. Wagner, R-6 Engineering U.S.F.S., and Mr. Coldwell of Arcadia met at the Holt plant on September 21, 1961, to discuss revisions of the Oregon Press Seeder.

Some of the points covered were:

1. A revised chain drive.

2. Cast press wheels with a different shaft mounting.

3. Wheel frame mounting to provide one standard frame for all positions.

4. Simplified spring mounting.

5. Lowering of seed box.

6. Weight boxes.

It may appear from the various field reports that the Oregon Press Seeder needs considerable revision. However, the recommendations, although important, generally involve relatively minor revisions. The machine basically is still a desirable piece of equipment to accomplish the job for which it was designed--that is, in seeding dry-loose seed beds. Several thousand additional acres of rangeland were seeded to grass by these machines again last fall.

Arcadia reports, "Changes have been extensive--alterations have now been extended to every part of the machine except the drawbar. Currently the job of redrawing is about 50 percent complete."

Contour Trencher and Furrower

Subcommittee Chairman - Orval E. Winkler, FS

Arcadia reported test of the Holt contour trencher as follows:

The Holt reversible, tractor-mounted, 32-inch disc plow is now widely accepted as a very effective tool. The rigid hitch developed in Region 4 of the Forest Service has solved the most difficult problem reported at the last committee meeting. The three-point hitch originally used has been a major source of trouble.

Incorporated with the new hitch and fastened to the plow frame are hydraulic systems and shock absorber springs that allow for sideplay in both directions. The hitch also provides for the vertical movement of the plow discs when they strike solid objects in the furrow path.

Parts weaknesses reported last year have been corrected with the fabrication of stronger parts. The three-point hitch bracket has been replaced with a section of heavy wall tubing for use with a kingpin.

The new design has improved the plow unit by reducing the total weight and length of the plow. This was accomplished by the elimination of the arched frame from the front of the plow. A system built into the vertical hitch now provides for the regulation of plow furrow depth, thus eliminating the crazy wheel.

The new designs have resulted in a piece of equipment suitable to work on slopes somewhat steeper than 30 percent. Steeper slopes free of rock with deep soils may be plowed.

For watershed work the most successful unit now in use is equipped with 45-inch discs. This size of plow has performed excellently when mounted behind a TD-18 bulldozer-equipped International Harvester crawler tractor. In certain situations, however, the TD-18 was underpowered. A Caterpillar D-7 tractor in these circumstances would have been a better power unit. The most pronounced weakness with the heavier (45-inch) plow unit was found to be the collar on the kingpin hitch unit. This has been corrected with a collar made of stronger material.

The rigid vertical hitch was not used with this heavier plow. A kingpin hitch similar to the one used on the 32-inch model trencher, and lateral ram to handle side swing, have worked successfully. A unit thus equipped completed a major watershed job last year on the Uinta National Forest in Utah. On this job, and in field tests, the unit was worked approximately 225 hours with a minimum of lost time because of breakage.

Specifications for the vertical hitch for 32-inch Holt plows have been prepared for bid purposes. These specifications may be ordered through the Regional Office, U. S. Forest Service, Ogden, Utah. Current models are operating with a minimum of downtime on slopes in excess of 30 percent. Steeper slopes can be worked where soil depth is sufficient to keep the plow in the ground to stabilize the tractor. On rocky slopes above 25 percent, operation without a bulldozed trail for the tractor is dangerous.

It is the opinion of the committee that the rear-mounted 32- and 45-inch disc plows and hitches are now operational and that further development work on a project basis for these units is unnecessary.

The committee recommends continued study of front-end mounted 32-inch disc plows. It is proposed that further trials with these front-end mounted discs be carried out by the Forest Service in Region 4 in fiscal year 1963

A test of the Holt contour trencher was run by the AEDC in May 1961 as part of a test program for the Division of Timber Management. Since this trencher is of interest and has been used in range activities, it is reported here. As a basis for comparison the same tractor was used for constructing trench with a tilt type bulldozer blade. The blade was used in two positions--(1) uphill corner of the blade down, and (2) downhill corner of the blade down. The results indicate that the Holt disk trencher is able to construct trench faster and on steeper slopes than the bulldozer blade.

COMPARATIVE PRODUCTION DATA

	Holt Trencher	John Deere 612 Bulldozer	
		Downhill Corner Down	Uphill Corner Down
Construction Time - hours	1.07	1.20	0.59
Total Trench Length - feet	3459	3137	1190
chains	52.4	47.5	18.0
Rate of Construction - feet/hr	3230	2610	2020
chains/hr	49	39	31
Volume of Harvest Moved - cu yd	67	44	75
Volume of Earth Moved per Lineal - cu yds/ft	0.0194	0.0140	0.1117
cu yds/chain	1.25	0.93	7.1
Rate of Earth moving--cu yds/hr	63	37	128
Rate of Water Storage Construction - cu yds/hr	135	175	0

The Divisions of Range Management and Watershed Management of the Forest Service, Southwest Region, have collaborated in financing the installation of a Holt Disc Trencher on a D-7 tractor equipped with Hula dozer and Juniper push bar.

An initial field test was conducted.

A conclusion drawn thus far in the test is that the hydraulic lift speed needs to be increased. Increasing the lift speed may require a larger gasoline engine with a proportionate decrease in pully ratio to the hydraulic pump, although additional speed may be realized by changing the present pully belt ratio with the idea of operating the engine at increased speed.

Another conclusion is that the thrust wheel should be replaced by one that sets at an angle, and runs against the side of the furrow to offset the side thrust of the disk. The present thrust wheel does not use the side of the furrow to advantage. Rather, the side thrust is held mainly by the cross chains and tractor.

Chemical Plant Control

Subcommittee Chairman - Donald Cornelius, ARS

Suggested revision of Handbook and raised question if new species should be added. It was recommended that more work be done with research on herbicides. Need method of funneling information out to various agencies.

Aerial Spraying

Subcommittee Chairman - Donald H. Euler, FS

No significant difference in kill between helicopter and fixed wing application. Costs of helicopter spraying were higher but preferred over fixed wing for other reasons. Helicopters now available in all areas and no difficulty experienced in getting bids.

Colored slides presented by Orval Winkler showing spraying job using invert emulsion, with special equipment designed to mix the emulsion. This formulation not satisfactory in this one trial for spraying big sagebrush because of poor kill.

Spray Equipment

Subcommittee Chairman - A. B. Evanko, FS

A 200-gallon unit was designed, mounted on an International TD-340 and limited tests made in 1960. The unit was specifically designed for mounting on a John Deere 440 tractor. The unit can be adapted to any tractor of comparable size with rigid track frames, 48-inch gauge tread and maximum engine compartment width of about 26 inches.

The more extensive tests in 1961 indicated the need for additional changes and/or modifications in both the spray unit and tractor.

Spray application to the vegetation was very satisfactory when the unit was functioning properly. Two especially desirable features of the unit are: (1) the selector valve allowing the use of individual or all sections of the boom as conditions require, and (2) the hand gun for individual plant treatment.

It appears to be the consensus of operator opinion that a tractor with a wider gauge is required for stability on side slopes. Operators used in the 1961 tests were reluctant to negotiate slopes of more than 25 percent. Slope is rapidly changed when the uphill track passes over a rock or stump.

Recommendations

1. Correct spray unit deficiencies noted above.

2. Consider reduction of tank size to about 60 gallons each for commercially available tractors with 48-inch track centers.

3. Investigate the possibility of widening tracks to 60-inch or 68-inch gauge. An attachment for John Deere tractors that may be practicable can be obtained from the Horace Stuart Company, Salinas, California. If this is not economical or feasible, the Oliver tractor which is available in 60-inch and 68-inch gauges, should be considered.

4. Contingent upon Recommendation 3, redesign spray unit to adapt to wider gauge tractor. Tank capacity should probably not exceed about 60 to 75 gallons each. Conduct performance tests.

Development of Hitches

Subcommittee Chairman - Orval E. Winkler, FS

Hitches of three types were to be further developed during fiscal year 1961.

1. Develop a three-plow hitch for brushland plows with hydraulic units for steering and lifting.

2. Design a hitch for rangeland drills.

3. Investigate the possibility of designing a suitable hitch for larger Holt disc plows.

Tandem, three-plow, hitches have been in use for five years in Region 3 of the Forest Service. On those areas suitable for the use of the hitch in Region 3, it has been possible to plow an 18-foot swath with three plows drawn by a D-7 tractor.

Designs for triple and tandem plow hitches have been prepared by the Arcadia Equipment Development Center. The Bureau of Land Management has been working on multiple hitch designs in Oregon.

A three-drill hitch design for rangeland drills has been prepared by the Arcadia Equipment Development Center. This design was prepared after investigating several styles. The prime consideration in its preparation was simplicity in design coupled with light weight.

We suggest the design of this BLM two-drill hitch be included in the new Operators Maintenance Manual, using the larger size wheels.

With reference to a tow-hitch behind the brushland plow, the long A-frame of the three-drill can be used with its 12-foot reach from hitch ring to front of drill wheels.

Modifications in the hitch design and other structural elements of the Holt plow were made in Region 4 of the Forest Service in 1961.

Specifications suitable for the solicitation of bids for the manufacture of the vertical lift hitch, shown in the attached illustration for 32-inch plows can be obtained from Region 4 of the Forest Service.

The Region 4 modifications for the 32-inch disc plow consist of (a) replacing the three-point hitch bracket with a section of heavy wall tubing for use with a kingpin, (b) addition of a side-swing control ram coupled with a spring shock absorber mounted on the trencher main beam, (c) elimination of depth control wheel. The redesigned unit is ready for final acceptance in Region 4.

Color movie illustrated this report.

Evaluate Mulching Machines

Subcommittee Chairman - Harry W. Pearson, BLM

Problems to be solved in the mulching of rangelands, as I see it, are: (1) to get the mulch on the ground effectively and economically, and (2) to keep it there. Rotobeaters of various types, the Marden Brush Cutter, the Brushland and Wheatland plows are fairly well-known methods of getting a mulch in the ground when these implements are used in the treatment and seeding of brushlands. The effective and economical mulching and seeding of rangelands having little or no vegetal cover, and such areas are potentially large in extent, would most certainly be a worthwhile practice.

Developing methods and machines or evaluating existing machines for mulching large range areas suitable for seeding and for keeping the mulch on the ground once placed, needs, I believe, serious attention. From the information I was able to obtain, the mechanical spreading of mulch on a large scale is accomplished mostly by blowers and this along highways. The mulch used is hay or straw and, of course, for range seeding purposes such mulch should be free from those noxious weeds detrimental to rangelands. On steep slopes along highways a sheepsfoot roller is often used to mix the mulch with the surface soil, a method and concept that would appear to have application in range seeding. The roller would need to be of lightweight and to cover a much larger area than such rollers used in earthwork construction. It is possible, I believe, that the economics of the problem may require the spreading of mulch, its incorporation in the soil and the seeding to be accomplished in one operation. It may also be, once better understood, the application of fertilizer should become a part of the same operation.

Report on Unscheduled Servicewide Services

Eugene Silva presented the financial statement of the range reseeding development work carried out at the Arcadia Equipment Development Center. Work at the Center has progressed very satisfactorily. Most of the work scheduled has been accomplished, with completion scheduled for remaining work. Silva discussed new equipment developments. New pitting machine. Two brush and tree cutters which will handle up to 18" trees. Power sprayer with 4-lb. motor for completely portable use with a spray boom.

Exploratory Subcommittee

Subcommittee Chairman - John Killough, BLM

Purpose of Committee. To explore the field for new or additional needs for equipment to accomplish range seeding and restoration, and to sift ideas for new projects to be presented annually to general committee. This committee should also recognize that close coordination must be maintained with nonequipment programs which benefit rangelands.

The following suggestions for consideration were presented:

1. Inter-seeder for old crested wheat seedlings to be used without seedbed preparation.

2. Study and evaluation of pitting machines.

3. Device for maintaining tractor on level grade.

4. Brush Cutter-hogger.

5. Roller for crushing brush prior to burning.

6. Machine to lay plastic pipe.

7. Fence building machine.

Consideration of Committee reports and project writeup with decision for 1962 work program as follows:

Old Projects

Operating Hints and Service Manual Handbooks

Subcommittee recommendations accepted. Subcommittee will follow through. Brush Cutter and Oregon Press Seeder Manuals postponed until F.Y. 1964.

Rangeland Drill Improvement

Subcommittee to be continued, but no work scheduled for two to three years.

Improvement of Brushland Plow

Subcommittee to be discontinued.

Acquire Parts for Equipment

Everett Doman to coordinate this. It is requested that the procedure for acquiring parts as now established be fully explained and followed by all agencies and all Regions.

Browse Seeding Equipment

Continue subcommittee, plan of work as written up on work sheet. Copy attached and one copy sent to all committee members.

Browse Seed Collector

Continue subcommittee; plan of work as written up on work sheet. Copy attached and one copy sent to all committee members.

Catchment Basin

Committee to continue under same work plan as last year.

Brush Cutting

Committee to continue under plan of work as written. Copy attached and one copy to committee members.

Evaluate Root Plow

Committee to continue with same work plan as 1961.

Develop Broadcast Seeder

Question of continuing this committee. Decision made to continue for this year. Arcadia will prepare final report.

Improve Oregon Press Seeder

Committee to continue as indicated in attached work plan. Name of committee changed to "Improvement of Oregon Press Seeder."

Contour Trencher and Furrower

Committee to finalize this project this year.

Chemical Plant Control

Committee to continue with no change in program.

Aerial Spraying

Committee to be continued. Name of committee changed to "Aerial Applications." Program to include application of seed and fertilizer as well as herbicides.

Development of Hitches

Committee to be continued as indicated in attached work plan. Brushland plow hitch study to be discontinued.

Evaluate Mulching Machine

Committee to be discontinued for this year. Possibility of reactivating this committee to be discussed in 1963 meeting.

New Project Proposals

Front End Mount Contour Trencher

Project proposal accepted; to be presented to TEB for consideration by other functional activities--Watershed and Timber Management. Range Reseeding interested but not to the extent Watershed and Timber Management will be.

Front End Brush Cutter for Gyro Cats

Project not accepted by committee. Recommend that it be further investigated and considered as a possible project at 1963 meeting.

Trailer for Oregon Press Seeder

Project not accepted. Recommended that Hank Mullins write this up for distribution to all members.

Backpack Browse Seed Collector

Committee accepted this proposal. Writeup is included in Browse Seed Collection Project writeup for 1962.

Electronic Herbage Production Meter

Committee did not accept this proposal. Suggested that this is an area of research which should be directed to ARS and the Beltsville Electronics Laboratory.

Inter-Seeding Equipment

This proposal did not reach the point of being submitted as a project. Various ideas were discussed; use of rangeland drill, use by adoption of the browse planter, etc. However, there was enough discussion to warrant further investigation. A subcommittee is appointed to investigate this situation and report to 1963 meeting.

Brush Cutter-Chipper

This proposal accepted as a new project. Project Plan written and committee appointed.

Plastic Pipe-laying Machine

This proposal accepted as a new project. Project Plan written and committee appointed.

Fence Building Machine

This proposal accepted as a new project. Project Plan written and Committee appointed.

SUBCOMMITTEE ASSIGNMENTS FOR FY 1963

Operating Hints and Service Manual Handbooks

A. C. Hull, Chairman	ARS	Logan, Utah
Joe Wagner	BIA	Washington, D. C.
John R. Killough	BLM	Washington, D. C.
J. A. Downs	SCS	Albuquerque, New Mexico
Eugene Silva	FS	Arcadia, California
Henry Mullin	FS	Albuquerque, New Mexico

Subcommittee on Rangeland Drill Improvement

A. B. Evanko, Chairman	FS	San Francisco, California
W. F. Currier	FS	Albuquerque, New Mexico
Howard DeLano	BLM	Portland, Oregon

All suggestions for this committee to be channeled to chairman.
No action program for 1962.

Subcommittee to Acquire Parts for Equipment

Everett Doman, Chairman	FS	San Francisco, California
Joseph H. Sonntag	FS	San Francisco, California

Browse Seeding Equipment Subcommittee

Perry Plummer, Chairman	FS	Ephraim, Utah
Richard L. Hubbard	FS	Susanville, California
Robert Boone	F&WL Serv.	Portland, Oregon
Anthony Evanko	FS	San Francisco, California
Hugh A. Harper	Idaho F&G Dept.	Boise, Idaho
Wilbur Currier	FS	Albuquerque, New Mexico
Walter McGregor	Cal. F&G Dept.	Sacramento, California
George Burma	BLM	Sacramento, California
Dick McEldery	BLM	Billings, Montana
Lawrence Riordan	Colo. F&G Dept.	Denver, Colorado
Norman Hancock	Utah F&G Dept.	Salt Lake City, Utah

Subcommittee on Browse Seed Collector

Max Bridge, Chairman	BLM	Reno, Nevada
Charles W. Howard	FS	Arcadia, California
Wm. Dasmann	FS	San Francisco, California
R. N. Denny	Colo. F&G Dept.	Fort Collins, Colorado
Wally McGregor	Calif. F&G Dept.	Sacramento, California
Perry Plummer	FS	Ephraim, Utah

Catchment Basin Subcommittee

W. F. Currier, Chairman	FS	Albuquerque, New Mexico
Glen Lipscomb	BLM	Phoenix, Arizona
Joseph B. Chiarella	BIA	Phoenix, Arizona
C. W. Lauritzen	ARS	Utah St. Univ., Logan,Utah

Brush Cutting and Brush Beating Equipment

William Malencik, Chairman	BLM	Reno, Nevada
A. B. Evanko	FS	San Francisco, California
George T. Nordstrom	BIA	Sacremento, California

Subcommittee to Evaluate Root Plows

Carl Fonte, Chairman	SCS	Colorado Springs, Colorado
Donald H. Euler	FS	Denver, Colorado
Morris Tragstad	BLM	Santa Fe, New Mexico
Wm. McGinnies	ARS	Fort Collins, Colorado
Joseph Chiarella	BIA	Phoenix, Arizona
W. F. Currier	FS	Albuquerque, New Mexico

Subcommittee to Develop Broadcast Seeder

Danny Hess, Chairman	BLM	Spokane, Washington
Richard Hubbard	FS	Susanville, California
Norman Hancock	Utah F&G Dept.	Salt Lake City, Utah
A. B. Evanko	FS	San Francisco, California
	FS	Portland, Oregon
Duane Jensen	BLM	Salt Lake City, Utah

Subcommittee to Improve Oregon Press Seeder

Howard DeLano, Chairman	BLM	Portland, Oregon
Don Hyder	ARS	Corvallis, Oregon
	FS	Portland, Oregon
Dean Booster	Ore. St. Col.	Corvallis, Oregon

Subcommittee for Contour Trencher and Furrowers

Orval E. Winkler, Chairman	FS	Ogden, Utah
W. F. Currier	FS	Albuquerque, New Mexico
Burt Silcock	BLM	Boise, Idaho
LaMar Mason	SCS	Murray, Utah

Subcommittee on Chemical Plant Control

Donald R. Cornelius, Chairman	ARS	Berkeley, California
Don Hyder	ARS	Burns, Oregon
Fred H. Tscherley	ARS	Tucson, Arizona
Claire Lotson	BLM	Cheyenne, Wyoming
W. C. Robocker	ARS	Reno, Nevada
Lowell K. Halls	FS	Tifton, Georgia
Hurlon Ray	SCS	Albuquerque, New Mexico
	FS	Portland, Oregon

Subcommittee on Aerial Application

Donald H. Euler, Chairman	FS	Denver, Colorado
Wm. Evans	FS	Missoula, Montana
Orval E. Winkler	FS	Ogden, Utah
Leroy Sweet	BLM	Denver, Colorado
Warren Sondau	BLM	Portland, Oregon

Subcommittee on Spray Equipment

A. B. Evanko, Chairman	FS	San Francisco, California
C. A. Graham	FS	O'Neals, California
Verdie White	FS	Glendora, California
W. F. Currier	FS	Albuquerque, New Mexico
George T. Nordstrom	BIA	Sacramento, California
Fred Davis	BLM	Sacramento, California

Subcommittee on the Development of Hitches

Orval E. Winkler, Chairman	FS	Ogden, Utah
Don Hunter	BLM	Salt Lake City, Utah
Henry Mullin	FS	Albuquerque, New Mexico

Exploratory Subcommittee

John R. Killough, Chairman	BLM	Washington, D. C.
Anthony Evanko	FS	San Francisco, California
Grahm Rice	BIA	Portland, Oregon
Dean Booster	Ore. St. Col.	Corvallis, Oregon
A. C. Hull	ARS	Logan, Utah
B. W. Allred	SCS	Washington, D. C.
Norman Hancock	State F&G Dept.	Salt Lake City, Utah

Brush-Cutter Auger Subcommittee

A. B. Evanko, Chairman	FS	San Francisco, California
W. F. Currier	FS	Albuquerque, New Mexico
Carl Rice	BLM	Sacramento, California
George T. Nordstrom	BIA	Sacramento, California

Plastic Pipe-laying Machine Subcommittee

Grant Rogers, Chairman	BLM	Salt Lake City, Utah
Joe V. Chiarella	BIA	Phoenix, Arizona
Wm. Evans	FS	Missoula, Montana

Fence Building Machine Subcommittee

Orval Winkler, Chairman	FS	Ogden, Utah
W. F. Currier	FS	Albuquerque, New Mexico
Maurice W. March	BLM	Cheyenne, Wyoming

FINANCIAL SUMMARY

AS OF JANUARY 15, 1962

BY AEDC

TEB No.	Project	Prior.	Forest Service Author.	Oblig.	Bal.	Bur.Land Management Author.	Oblig.	Bal.	Other Author.	Oblig.	Bal.	Bur. Indian Affairs Author.	Oblig.	Bal.
									Wildlife Man.					
035	Rangeland Drill	2				1,000	695	305	3,000	1,140	1,860			
328	Brushland Plow	6				1,000	360	640						
									Watershed Man.					
501	Brush Cutter	1				1,500	4,427	-2927	1,000	1,000	--	1,000	1,000	--
502	Browse Seeder	4				600	163	437						
701	Develop Hitches	3	600	742	-142	600	538	62						
702	Contour Trencher	11	600	150	450	600	238	362						
704	Spray Equipment	5	1,800	955	845	400	104	296						
832	Unscheduled	-	4,300	2,252	2,048									
901	Broadcast Seeder	8	1,000	281	719	1,000	250	750						
1010	Seed Coll. Equip.	10	1,500	1,937	-437	1,000	1,015	-15						
1101	Oregon Press Seeder	7	500	1,114	-614	1,500	1,659	-159						
1102	Eval. Mech. Mulcher	9	700	175	525	800	200	600						
	TOTALS		11,000	7,606	3,394	10,000	9,649	351	4,000	2,140	1,860	1,000	1,000	--

M-4055

Priority List of Projects with Estimated Costs Developed at Meeting

BUDGET FOR PROJECT PROPOSALS
F. Y. 1963

TEB		Proposed Total	Proposed Arcadia	Authorized by Inter-Agency Committee 5/4/62 Amount	Authorized by Inter-Agency Committee 5/4/62 Location
502	Browse Seeder	$ 1,500	$ 500	$1,500	$1000-R-4 500-AEDC
1010	Browse Seed Collector	5,700	5,700	5,700	AEDC
501	Brush Cutters	1,300	1,300	1,300	AEDC
1101	Oregon Press Seeder	4,000	4,000	4,000	AEDC
702	Contour Trencher	2,300	1,000	2,300	1300-R-4 1000-AEDC
704	Spray Equipment	4,400	4,400	4,400	AEDC
	Development of Hitches*	500	[illegible]	500	R-4
	Technical Services**	3,500	3,500	8,500	AEDC
	New Projects				
1222	Brush Cutter Chipper	4,000	4,000	4,000	AEDC
1223	Plastic Pipe-Laying Machine	2,800	2,800	2,800	AEDC
1221	Fence Building Machine	4,000	500	4,500	3500-R-4 500-AEDC
	Two-Way Hula Dozer Plow	25,000	5,000	Not approved	

* To be included on unscheduled list for Arcadia.

**Includes 1/2 man year for A.E.D.C. for Project Development.

Program for the 1962 Meeting
Range Seeding Equipment Committee

Sixteenth Annual Meeting
January 21 and 22, 1962

Robert Driscoll Hotel
Corpus Christi, Texas

GENERAL CHAIRMAN - Frank J. Smith, Forest Service

January 21

Discussion Leader - John R. Killough, BLM

9:00 A.M. - Report on Operating Hints and Service Manual Handbooks
A. C. Hull, Chairman of Subcommittee, ARS.

9:15 A.M. - Range Drill Improvement - A. B. Evanko, Chairman of Subcommittee, FS.

9:30 A.M. - Improvement of Brushland Plow - Roy Sweet, Acting Chairman of Subcommittee, BLM.

9:45 A.M. - Acquire Parts for Equipment - Everett Doman, Chairman of Subcommittee, FS.

10:00 A.M. - Browse Seeding Equipment - Perry Plummer, Chairman of Subcommittee, FS.

10:30 A.M. - Browse Seed Collector - Max Bridges, Chairman of Subcommittee, BLM.

11:00 A.M. - Catchment Basins - C. E. McDuff, Chairman of Subcommittee, FS.

11:30 A.M. - Brush Cutting and Brush Beating Equipment - O. P. DeJulio, Chairman of Subcommittee, BLM.

Discussion Leader - A. C. Hull, ARS

1:00 P.M. - Evaluate Root Plows - Carl Fonte, Chairman of Subcommittee, SCS.

1:30 P.M. - Develop Broadcast Seeder - E. E. Silva, Chairman of Subcommittee, FS.

2:00 P.M. - Evaluate Oregon Press Seeder - Howard DeLano, Chairman of Subcommittee, BLM.

2:30 P.M. - Contour Trencher and Furrower - Orval Winkler, Chairman of Subcommittee, FS.

January 21 (Continued)

3:00 P.M. - Chemical Plant Control - Donald Cornelius, Acting Chairman of Subcommittee, ARS.

3:15 P.M. - Aerial Spraying - Don Euler, Acting Chairman of Subcommittee, FS.

3:30 P.M. - Spray Equipment - A. B. Evanko, Chairman of Subcommittee, FS.

4:00 P.M. - Development of Hitches - Orval Winkler, Chairman of Subcommittee, FS.

4:15 P.M. - Evaluate Mulching Machines - Harry W. Pearson, Chairman of Subcommittee, BLM.

January 22

Discussion Leader - Joe Wagner, BIA

8:00 A.M. - Report on Unscheduled Servicewide Services - E. E. Silva, FS.

8:30 A.M. - Exploratory Subcommittee

1. Receive new project proposals.

10:30 A.M. - Subcommittee to draft project writeups for FY 1963.

12:00 Noon

Discussion Leader - Frank J. Smith

2:00 P.M. to 4:00 P.M. - Group consideration of project writeups. Assign priorities.

Followup on financial arrangements meeting planned in Washington Office with E. E. Silva and agency representatives in April.

Meeting adjourned 12:00 Noon, January 23, 1962.

Register of Attendance

U. S. DEPARTMENT OF AGRICULTURE

Agricultural Research Service

R. F. Dudley	Research Division, Bushland, Texas
C. W. Lauritzen	Logan, Utah
Donald R. Cornelius	Berkeley, California
A. C. Hull, Jr.	Logan, Utah
Wesley Keller	Beltsville, Maryland

Agricultural Extension Service

Wayne G. McCully	Texas AES, College Station, Texas
Garlyn O. Hoffman	Texas AES, College Station, Texas

Forest Service

Lloyd W. Swift	Washington 25, D. C.
Charles W. Howard	Arcadia Equip. Dev. Center, Arcadia, Calif.
D. H. Euler	Denver, Colorado
A. Perry Plummer	IM, Ephraim, Utah
Orval E. Winkler	Ogden, Utah
John L. Rogers	Baker, Oregon
E. E. Silva	Arcadia Equip. Dev. Center, Arcadia, Calif.
Everett R. Doman	San Francisco, Calif.
J. H. Sonntag	San Francisco, Calif.
L. A. Waggener	Portland, Oregon
H. A. Mullin	Albuquerque, New Mexico
W. L. Evans	Missoula, Montana
A. B. Evanko	San Francisco, Calif.
W. F. Currier	Albuquerque, New Mexico
Eamor C. Nord	Berkeley, California
Wayne W. West	Atlanta, Georgia
I. Pat Murray	Albuquerque, New Mexico
Selar S. Hutchings	IM, Ogden, Utah
John S. Forsman	Billings, Montana

Soil Conservation Service

C. S. Fonte	Box 4126, Colorado Springs, Colorado
Harry H. Wegeleben	314 Federal Bldg., Yakima, Washington
J. A. Downs	Albuquerque, New Mexico
B. W. Allred	Washington 25, D. C.
Ivan W. Dodson	Las Cruces, New Mexico
Waldo R. Frandsen	Salt Lake City, Utah
Hurlon Ray	Albuquerque, New Mexico
James Morgan	Estancia, New Mexico
Robert Abercrombie	Bluewater, New Mexico
H. D. Galt	Magdalena, New Mexico

U. S. DEPARTMENT OF THE INTERIOR

Bureau of Indian Affairs

Joseph A. Wagner	Washington 25, D. C.
Joseph V. Chiarella	Phoenix, Arizona
George T. Nordstrom	P. O. Box 749, Sacramento 4, Calif.

Bureau of Land Management

Myrvin E. Noble	Washington 25, D. C.
W. J. Anderson	Box 1251, Santa Fe, New Mexico
Chesley P. Seely	Santa Fe, New Mexico
E. J. Petersen	Federal Bldg., Sacramento, Calif.
Don Dimock	Sacramento, California
John R. Killough	Washington 25, D. C.
Richard D. McEldery	Billings, Montana
Burt Silcock	Boise, Idaho
A. Keith Miller	Cheyenne, Wyoming
Bill Malencik	Reno, Nevada
William L. Mathews	Washington 25, D. C.
Maurice W. March	Cheyenne, Wyoming
Howard R. DeLano	Portland, Oregon
Max W. Bridge	Reno, Nevada
Roy W. Bean	Denver, Colorado
Leroy C. Sweet	Denver, Colorado
Grant P. Rogers	Salt Lake City, Utah
H. W. Pearson	Santa Fe, New Mexico
Robert D. Martin	Boise, Idaho
Glenn Lipscomb	Phoenix, Arizona
Leon R. Nadeau	Washington 25, D. C.

Fish and Wildlife Service

Bruce Stollberg	Washington 25, D. C.

COLORADO STATE UNIVERSITY

Bill E. Dahl	Akron, Colorado

COLORADO FISH & GAME DEPARTMENT

Lawrence E. Riordan	Denver, Colorado

UNIVERSITY OF ARIZONA

Robert W. Marquiss	Tucson, Arizona

INTERNATIONAL COOPERATION ADMINISTRATION

A. K. Majumdar	(India) c/o Mr. L. M. Adcock, FAS, Washington 25, D. C.

MISCELLANEOUS EQUIPMENT COMPANY REPRESENTATIVES

Joe Frankenberg	FLECO Corporation, Jacksonville, Florida
N. Thomason	Farmterials, P. O. Box 894, Baker, Ore.
Dick Haynes	Farmterials, P. O. Box 894, Baker, Ore.
Jack M. Fletcher	Holt Caterpillar Co., Box 338,Portland,Tex.

RANCHERS

Lyman Linger	Box 25, Loveland, Colorado
W. B. Finley	Fredonia, Arizona